REVIEWS.

SPONGES.*—Professor Hæckel in this paper has condensed the results of an extended and very remarkable series of investigations with regard to the affinities of the Sponges.

He places them nearest the corals, considering their canal system as homologous with the stomach and circulatory system of the corals. He farther identifies their structure by showing that in both of these types the primitive body wall consists of two layers, an outer homogeneous, which however, springs from an originally cellular layer, and an inner cellular membrane. This comparison is carried so far that as in the Cœlenterata (Acalephs and Polyps) the large vessel, which conveys away the water admitted through the sides by the smaller branches permeating the mass of the sponge, is called the stomach. Sponges are also stated to be either simple or compound, to be composed of one or more individuals in proportion as they have one or more afferent openings. Of course Professor Hæckel is well aware of the principal objections to his theory, and states them. The mouthless sponges, for instance, he accounts for by referring to the mouthless Sycocystis, which, however, has young with a well formed mouth. The fact, however, that the water permeating the sponge-body goes through minute apertures in the wall itself and is ejected at the so-called mouth, is not encountered with quite the same success. The cutaneous pores of the corals are supposed to be the same as these minute pores, and are supposed to perform the same or a similar office for the animal. The egg of the sponge (Prosycum) is said to pass through the mulberry condition, after which it becomes hollow and clothed with cilia. This cavity enlarging finally breaks through one end, and forms a mouth opposite to the end which has already become attached to the rocks. At this young stage it is said to be not essentially different from a fresh-water Polyp, or a young coral.

The author nowhere alludes to the late memoir of Prof. H. J. Clark, the most conclusive of any that has yet appeared, advocating the compound nature of the sponge. In this memoir it is clearly shown that in Leucosolenia, a marine sponge, the cells of the inner membrane lining the cavity (stomach of Hæckel) are monads and not true cells. That they have the single flagellum surrounded by a vail, or calyx, and contained contractile vesicles and particles of food in various states of digestion. Carter's observations, as well as Professor Hæckel's, distinctly confirm the flagellate, or single-haired, condition of the cells of the internal membrane, and the structureless, gelatinous nature of the external layer.

* On the Organization of Sponges and their relationship to the Corals. By Ernest Hæckel (Translated in the Ann. and Mag. Nat. History Jan., 1870, from the Jenaische Zeitschrift B. v. p. 207).

Professor Clark found that the monads, hitherto considered one of the simplest forms of animal life, had a similar flagellum, but that this was used to procure food, which he distinctly saw as it entered the sac-like body through a mouth situated at its base. The lip of this mouth spread itself over the morsels which descended into a digestive vesicle in the interior of the body. The series from this point to the sponge is completed by a form, Salpingœca, which with the same characteristics also secretes a gelatinous envelope. These anatomical facts fully justified the author of the memoir alluded to in claiming that he had discovered the true nature of the sponges, and they appear to indicate a much closer affinity between the sponges and the Uniflagellate Infusoria, and appear much more decisive than the coral-like characteristics described by Professor Hæckel.

The comparison of the aquiferous systems of sponges with the true stomach cavity and circulatory vessels of the coral is more than doubtful. The objection that the current flows in opposite directions cannot be met by comparing the perforations of the body wall in corals with those of sponges. It is well known that these perforations are common also in the star fishes and Polyzoa, and their precise import in either is as yet unknown. The most rational view would seem to be the opposite of Hæckel's, *i. e.*, that the pores are the mouths, and the so-called mouths the anal orifices, since out of these is all the refuse of the body thrown. Describing the radiating canals of Cyathiscus, the author asserts that the horizontal walls which divide these canals are absorbed, and the vertical walls are left standing, and thus a series of radiating chambers are produced, similar to those of the corals. Farther, that the only difference between them is that in corals the central stomach opens below into the common cavity, into which also the radial chambers open, and in Cyathiscus the stomach opens directly into the radial chambers by series of vertical pores, the former mouths of the lateral canals. This is perhaps the very strongest evidence brought forward by Professor Hæckel, and it is certainly a most interesting and remarkable fact, but seems hardly conclusive. The formation of the radiating partitions in the corals by the infolding of the inner membranes of the walls, is a very different process from that described above in Cyathiscus. How can we account for the fact that an individual with a large stomach cavity, and a set of circulatory vessels, has arisen when no useful end whatever could have been secured thereby? What useful end, or of what advantage is it to the species as an individual to possess numerous minute pores to admit food and rapidly enlarging canals, abutting finally in a large trunk to facilitate its emission. This is just the reverse of the economy of the organization of every individual, as such, in the animal kingdom. Individuals are universally possessed of facilities for obtaining and swallowing food in the shape of large pliable mouths and stomachs, whereas the emission of the refuse takes place through the smaller end of the canal or through the mouth again.

For the proper support of an individual it is evidently necessary that the food, whether microscopical in size or not, should be obstructed in its passage through the body and subjected to a thorough process of digestion. According to Professor Hæckel, however, we have in the sponge a creature in which all this is reversed, and a digestive system is presented to us which is perpetually increasing its facilities for getting rid of food as fast as it is swallowed. How this reversal of the animal economy can be of service to the race we cannot see, so long as we regard the sponge as an individual, or an aggregation of large individuals; but if on the other hand we adopt the opinion of his opponents, then all these difficulties disappear. We then see that the pores act as a strainer admitting only bodies of small size, such as are appropriate for the sustenance of the monads, which cover the internal surfaces of the canals. The gradual enlargement of these canals into a central trunk becomes at once appropriate, when we compare it with the similar facilities which are found in all compound communities for relieving the colony of refuse and deleterious matters. The fact noticed by the author, with marked emphasis, that each cell of his entoderm (internal membrane), is armed with a single flagellum is also explained, and the vase-like form of these cells noticed by Carter, and the amœba-like character of the external membrane, accords equally well with this view. We do not find in this article in fact any remarks which lead us to think that Professor Hæckel has paid such full attention to the structure of the single cells of his inner membrane as would justify him in adopting an opinion so entirely opposed to that which we have advocated. Of course in his forthcoming work this point may be more fully treated of; and since the whole discussion hangs upon a question of fact as regards the structure of the single cells of the internal membrane we may look for an early solution of this vexed question.

If we dropped the review here it would be treating Professor Hæckel with great injustice. Though forced to criticise the main point of his theoretical deductions, the studies upon which they are founded, like the other works of this eminent German zoologist, will be deeply felt in the history of the progress of knowledge in this department.

The account of the function and structure of the ectoderm, and of the development of the "ova" from special forms of his so-called cells of the internal membrane are of the greatest interest and importance. That, also, of the gradual development of the canal system gives us an entirely new and original view of sponge structure. In this connection the remarkable statements are made that species of Nardoa, Nardopsis and Cænostoma begin with a single stock which subsequently branches, only however to coalesce again as they approach maturity and unite their various apertures into one common trunk and single aperture; and also, that we can trace the origin of a species from the common stem form. To illustrate this last assertion the author instances two species, *Guancha blanca* and *Sycometra compressa*, whose variations are so great, and indi-

cate affinities, with so many different groups, that he has been obliged to place them in a separate order by themselves. "*Sycometra compressa appears as a sponge stock which bears upon one and the same cormus the mature forms even of eight different genera.*"

In conclusion Professor Hæckel begs all of his readers who may be in possession of specimens of calcareous sponges to send them to him for examination and comparison.

THE EXTINCT MAMMALIAN FAUNA OF DAKOTA AND NEBRASKA.* — This important work is the final expression, the author informs us, of labors extending over a period of twenty-three years, during which the materials on which it is based, have been accumulating. Sufficient time has elapsed to allow of corrections of first identifications, and we have the result in a memoir of much completeness and accuracy in the topographical descriptions of the remains preserved in such unusual perfection and abundance in the localities in question. Fortunately the Academy of Natural Sciences of Philadelphia numbers among its members liberal minded men of wealth, for without the "sinews" of the undertaking furnished by Messrs. Joseph Jeanes and William P. Willstach, this work would not have seen the light. As it is, the execution both in printing and lithography, is a credit to all concerned.

The species hitherto discovered in the Bad Lands belong to two series of strata, determined many years ago by Dr. F. V. Hayden to be Miocene and Pliocene respectively. Fossils from these, and a few of Postpliocene age are included. derived from the area in question. The whole number described is eighty-six, distributed as follows: Carnivora, fifteen; Artiodactyla, thirty-four; Perissodactyla, twenty-nine: Rodentia, six; Insectivora, two. With reference to the relations of the genera and species, we let the author speak, by quoting his valuable summary at the close of the descriptive portion of the work:

"In comparing the two lists representing the North American tertiary mammals, mainly from the states of Dakota and Nebraska, with the third list representing the quaternary mammals of the same continent, a remarkable dissimilarity is observed, and there is also noticed a greater resemblance of the former with the tertiary and quaternary mammals of the old world.

Of thirty-two genera of miocene terrestrial mammals, chiefly from the Mauvaises Terres of Dakota, not one occurs in the quaternary formation of North America; and of twenty-one genera of pliocene terrestrial mammals, chiefly from the Niobrara River of Nebraska, only eight are common to the quaternary formations of North America, and of these eight three are absent in the existing fauna of the continent. The eight genera alluded to as common to the pliocene tertiary and the quaternary formations are Canis, Cervus, Dicotyles, Mastodon, Elephas, Equus, Hipparion and Castor.

It is uncertain how far the species of Canis attributed to the Niobrara pliocene formation are peculiar to it. Part of the fossils may be quaternary, or perhaps, even recent remains. Of Cervus, part of the specimens referred to it may be of a recent species, while the antler viewed as pertaining to the same may represent a peculiar genus, subsequently extinguished. The only remains indicative of Dicotyles was an upper canine tooth which may really have belonged to a quaternary or perhaps a recent species. The remains of the pliocene mastodon

* The Extinct Mammalian Fauna of Dakota and Nebraska, with a Synopsis of the Mammalian Remains of North America. By Joseph Leidy, M. D., LL. D., preceded by an Introduction on the Geology of the Tertiaries of Dakota and Nebraska, by Professor F. V. Hayden, M. D.